



Issued September 18, 1913.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE GEORGIA STATE COLLEGE OF AGRICULTURE,  
ANDREW M. SOULE, PRESIDENT; DAVID D. LONG,  
IN CHARGE SOIL SURVEY.

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SOIL SURVEY OF BEN HILL COUNTY,  
GEORGIA.

BY

ALLEN L. HIGGINS, OF THE U. S. DEPARTMENT OF AGRICULTURE,  
AND DAVID D. LONG, OF THE GEORGIA  
STATE COLLEGE OF AGRICULTURE.

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HUGH H. BENNETT, INSPECTOR IN CHARGE SOUTHERN DIVISION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1912.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1913.

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., March 15, 1913.*

SIR: In the extension of the soil survey in the State of Georgia work was undertaken in Ben Hill County during the field season of 1912. This survey was made in cooperation with the Georgia State College of Agriculture, and the selection of this area was made after conference with the State officials and bore the indorsement of Hon. Dudley M. Hughes, within whose district the survey lies.

I have the honor to transmit herewith the manuscript report and map covering this work, and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1912, as provided by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### MAP.

Soil map, Ben Hill County sheet, Georgia.



# SOIL SURVEY OF BEN HILL COUNTY, GEORGIA.

By ALLEN L. HIGGINS, of the U. S. Department of Agriculture, and DAVID D. LONG, of the Georgia State College of Agriculture.

## DESCRIPTION OF THE AREA.

Ben Hill County is located in the southern section of Georgia, in what is known as the "wire-grass" region. It is bounded on the north by Wilcox and Telfair Counties, on the east by Coffee, on the south by Irwin, and on the west by Irwin and Turner Counties. It

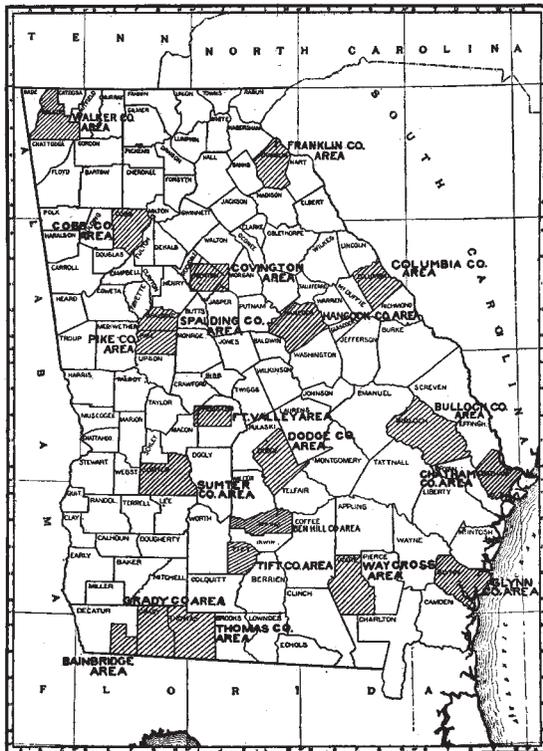


FIG. 1.—Sketch map showing areas surveyed in Georgia.

has an area of 256 square miles or 163,840 acres. The area is irregular in shape, approaching a rectangle, the greatest dimension being from east to west and measuring about 28 miles. The southern boundary of the area is about 70 miles from the Florida State line.

The base map showing the location of roads, towns, schoolhouses, churches, houses, and streams, was constructed with the plane table as the soil mapping progressed. No attempt was made to run out and

locate land lines, the soil boundaries being located with reference to other well-established features, such as roads, streams, houses, railroads, etc.

Ben Hill County embraces three distinct topographic divisions. The first is the "flatwoods," which occurs along the southern boundary of the county east of Ashton School, continuing with an average width of somewhat more than a mile, with the Broxton road as its approximate northern boundary for the entire distance. Another small area of "flatwoods" occurs along the eastern county line, about a mile from the southeastern corner, and also smaller areas 2 or 3 miles east of Fitzgerald. The next topographic division is the undulating to gently rolling country found in the southern part of the area, usually surrounding the "flatwoods," in many cases the change from one to the other being very gradual. It extends north from Fitzgerald a distance of 2 to 3 miles. In the western part of the county, where the drainage is toward the Allapaha River, this undulating to gently rolling country occupies the greater portion of this section. It extends east across the divide, where the drainage is in the other direction, and toward the Ocmulgee.

The largest portion of the county is included in the rolling to rough and hilly country in the northern part of the area. There the drainage is toward the Ocmulgee River. A striking feature of this section is the large number of streams which pass through it, forming a complete and very intricate drainage system. Where this rolling to hilly country joins the undulating section there is usually a more or less distinct escarpment from 25 to 50 feet in height. Streams that flow through the gently rolling area head on the very brink of this escarpment, the country above it being nearly level. Occasionally a stream has cut back through the bluff and drains some distance back in the more level section, but such cases are rare. A peculiar and very noticeable feature is the occurrence of amphitheater-like excavations about the heads of streams which rise below the escarpment. This feature is common all through this rolling to broken area, especially where it is roughest.

In this section the topography is so rolling that erosion has been extensive and interferes greatly with farming operations. Leaching is also injurious to crops in this section, particularly when fertilizers are applied to the soil.

The streams throughout the county have generally small strips of bottom land along their banks, varying in width from a few rods to a quarter of a mile or more, as along House and Stergeon Creeks. The streams usually head in areas of wet lowland, the bottoms proper developing and widening downstream, where the drainage channel becomes better defined. In the rougher section of the county the limits of the bottom lands are clearly defined, although there is

no pronounced bluff. In the more level areas the rise from the bottoms is so gradual that the difference in soils determines their outlines rather than any topographic difference. The bottom lands of all the larger creeks are subject to overflow in times of heavy rainfall and their channels as a rule are not distinct, the streams having a tendency to meander over the lowland. Along the Ocmulgee there is a fairly large area of bottom land, or "river swamp," as it is known locally, averaging from a quarter of a mile to a mile in width, although for some distance along the border of the county the river follows the southern bluff, the swamp being all in the county to the north.

Ben Hill County was formed in 1906 from parts of Wilcox and Irwin Counties. Fitzgerald was started in 1895 as a Union soldiers' colony and attracted a large number of settlers from the Northern States—Michigan, Indiana, Illinois, and Ohio. Many of them were unable to adapt themselves to the new conditions which they encountered here and, becoming discouraged, remained only a short time. However, many did stay and have a large influence on the character of the population in and around Fitzgerald. Farther out from Fitzgerald the population consists almost entirely of native Georgians who were born and reared within a few miles of where they are now living.

Fitzgerald, with a population of 5,795, is the only city in the county. Rebecca and Osierfield, towns of 250 inhabitants, are located only a short distance outside of the county and furnish trading points for portions of the area. Bowens Mill, Queensland, and Lula-ville are stations on the Seaboard Air Line and afford facilities for shipping and receiving supplies. Fitzgerald contains approximately one-half the population of the county, and a large proportion of the remainder live within a short distance, making the population largely urban. Of the total population of 11,183 for the county, the negroes constitute a large part.

Fitzgerald has a cotton mill, oil mill, and compress. The shops of the Atlanta, Birmingham & Atlantic Railroad are located here, so that the town does not depend entirely on agriculture for support.

Boats make regular trips on the Ocmulgee, bringing in guano, feedstuffs, and other supplies and carrying return cargoes of cotton and other products.

Considerable work is being done in improving the present county roads and building new ones, most of the roads at present being in fairly good condition. The clay subsoil in many places makes road upkeep difficult in times of heavy rainfall, a condition that might be remedied very largely by the addition of sand to the road material.

The elevation of the county is about 300 feet above sea level at Fitzgerald, and slightly higher to the north.

## CLIMATE.

The climate of Ben Hill County is very favorable for agriculture and permits the growing of a wide range of crops. The winters are short and comparatively mild, so that hardy vegetables can be grown throughout the year. Freezing temperatures occur only for short periods. Snow falls but rarely, remaining on the ground only a short time. The summers are long and warm, but not excessively hot, being tempered by cool breezes. Frosts seldom damage peaches or other fruit, either in the spring or fall.

The precipitation is ample throughout the year and at times excessive. Droughts sometimes occur during the summer months, causing damage to corn, cane, cowpeas, and other crops, although rarely causing cotton to suffer. This crop is more liable to injury by excessive precipitation, which causes too great growth of stalk.

The following table, taken from the records of the Weather Bureau station at Poulan, about 50 miles southwest of Fitzgerald, represents approximately the conditions in this county:

*Normal monthly, seasonal, and annual temperature and precipitation at Poulan.*

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	50	80	11	3.3	3.0	4.2	.....
January.....	48	83	10	3.5	2.1	3.9	0.1
February.....	51	83	-1	5.9	3.3	6.6	0.8
Winter.....	50	.....	.....	12.7	8.4	14.7	0.9
March.....	59	89	19	5.2	4.9	6.7	.....
April.....	64	91	27	2.9	2.2	4.2	.....
May.....	73	100	41	2.9	1.1	8.9	.....
Spring.....	65	.....	.....	11.0	8.2	19.8	.....
June.....	79	104	49	4.6	7.0	3.2	.....
July.....	81	102	56	6.2	5.4	4.9	.....
August.....	81	105	58	7.7	5.7	14.7	.....
Summer.....	80	.....	.....	18.5	18.1	22.8	.....
September.....	76	101	40	3.4	1.1	3.4	.....
October.....	66	93	32	2.6	0.6	1.6	.....
November.....	57	88	21	2.7	2.8	0.5	.....
Fall.....	66	.....	.....	8.7	4.5	5.5	.....
Year.....	65	105	-1	50.9	39.2	62.8	0.9

## AGRICULTURE.

Ben Hill County was originally covered with a heavy growth of longleaf yellow pine, the settlers clearing only sufficient ground to grow such crops as were needed for their own use. Most of them located along the Ocmulgee River as offering a means of communication with outside points. Lumbering and turpentine making have become important industries in the county within the last 25 years, and at the present time the bulk of the merchantable yellow pine has been removed. The turpentine industry, however, is still of considerable importance.

Stock raising occupied the attention of the earlier settlers, the cattle and hogs being allowed to run free and find their subsistence in the coarse grass found in the forest.

The Fitzgerald colony was established in 1895, and the completion of the Seaboard Air Line Railway to this point early in 1896 gave great stimulus to the development of agriculture in the county. The Atlanta, Birmingham & Atlantic Railroad was completed six years later, in 1901.

The principal crops are cotton and corn, although many others are grown. There is a tendency to break away from the old practice of depending entirely upon cotton, which is the money crop and will undoubtedly continue to be for some time. The area in cotton in 1910 was 15,231 acres, yielding 7,506 bales of 500 pounds. The high prices of that year caused a large acreage to be planted the following year. No Sea Island cotton is grown, although a little has been tried in an experimental way by a few farmers, with good results. It could be grown successfully on the better phase of the Tifton sandy loam if the price was sufficient to warrant it.

The acreage in corn is less than that in cotton, 11,160 acres being reported, with a yield of 150,707 bushels. Every farmer plans to produce enough corn to feed his stock and furnish meal for home use, but little is raised for market.

Oats are grown quite largely and there is a tendency to increase the acreage in that crop. According to the report for 1910 the crop was 37,089 bushels from 2,357 acres.

Some wheat has been grown for home use, but with indifferent success. It is not likely that this crop will ever become important in the county. Rye is grown for winter pasture, for which purpose it is very satisfactory. It is also cut and fed green. Cowpeas are grown to some extent and an increasing acreage is reported. The farmers are apparently beginning to realize the value of this crop in a definite rotation. The yield of grain has been rather unsatisfactory, but the yields of peavine hay average more than 1 ton per acre, and yields as high as 3 tons are reported. Velvet beans are an important

forage crop that is being grown more extensively each year. They are planted in the corn and used as pasturage for stock throughout the winter.

Nearly all farmers plant some peanuts, but the crop is not harvested, except a few for home use and enough for seed the following year. The crop is usually grazed off by hogs.

A patch of sugar cane large enough to furnish sirup for home use is found on nearly every farm. This crop is not produced for market to any extent, although it might be grown with profit.

Except around Fitzgerald, where enough truck is grown to supply local needs, trucking is not practiced on a commercial scale. Melons are grown for home use, but few are shipped out of the area.

Improvements in agricultural methods are taking place gradually. Modern farm implements are being introduced and their use is spreading throughout the county. The one-horse plow is still used to turn a great part of the land, but two-horse plows are becoming more common and a few disk plows are seen. Disk harrows are in common use and many disk drills are also found.

In preparing cotton land the practice preferred, though not always followed, is to plow the land level in the fall or winter and throw it into beds in the spring. The beds are usually 3 to 5 feet apart. The plants are thinned to stand 18 inches apart in the row. The fertilizer most commonly used is a 9-2-3 mixture in applications varying from 300 to 600 pounds per acre. The fertilizer is put in at the time of planting with occasionally another application when the plants are in bloom. Not enough attention is paid to the selection of seed. Several varieties are grown, the Gondola, Broadwell Double-Jointed, Cleveland Big Boll, Hastings Big Boll, Christopher, and Cooks Improved. The big-boll varieties seem to be the most popular. They are considered less subject to rust than other types of cotton.

Corn is planted either in the water furrow of the preceding year or on low beds. The soil is gradually worked toward the plants until at the time of laying by the land is nearly level, although frequently the plants stand on a fairly high ridge. The crop is planted in rows from 4 to 7 feet apart with the stalks from 2 to 3 feet apart in the row. When velvet beans or peanuts are planted in separate rows between the corn a greater width between the corn rows is given.

Corn is given about the same kind of fertilizer treatment as cotton, although the practice of making two or three applications instead of putting in all the fertilizer at one time is more common than in the case of cotton. Some nitrate of soda is used. This is usually applied just as the corn is beginning to tassel.

Oats are generally sown in drills on well-prepared land. The earlier-sown oats usually give best results, but the time of seeding varies greatly, from November until February or later. A large pro-

portion of the oats is cut for hay, but some are saved for the grain. Fairly large yields are obtained where good methods are employed. Oats are not fertilized as heavily as cotton or corn, but an application of nitrate of soda is considered necessary and usually made about the time the plants begin to head.

Pecan growing is an industry which, although not conducted on a large scale as yet, is of sufficient promise to deserve special mention. At present there are about 125 acres in pecans, 85 acres of which are in trees of bearing age. The indications are that the Tifton sandy loam is the soil best adapted to pecans. All the groves that have been set thus far have done well, but the groves are so young that it is impossible to make definite statements of the profits to be derived from them. The trees are usually set out 40 feet apart and the land planted to cotton until the trees are 5 or 6 years old. By that time the trees begin to draw heavily on the moisture and a grass crop is substituted for cotton. The trees begin to bear light crops at 6 or 7 years and at 10 years produce nuts in paying quantities. Several varieties are found in the established groves, among them the Columbia, Jewett, Van Deman, Stewart, Russel, Frotscher, Curtis, and Mobile. The Van Deman, while furnishing the largest and best nuts, is said to fruit sparingly, and growers are cutting these trees back and budding to other varieties.

Commercial fertilizers are used universally for all crops, the general belief being that it is impossible to grow crops without them. Many different brands, varying from an 8-2-2 to a 10-3-5, are used, with little regard to the kind of soil for which they are intended. The tendency at present is to use the higher-grade fertilizers. Green cotton seed is used to a large extent as a fertilizer. It is usually prepared by composting with barnyard manure and some phosphate and kainit added.

About 50 per cent of the farms in the county are operated by the owners, who frequently have little help except from their own families. Several systems of handling farming lands are followed. Some landowners hire all help and operate the land themselves. Others rent to tenants sometimes for a stipulated rental of lint cotton, others for half the crop when the tenant furnishes the tools and stock and one-half the fertilizer and the landlord furnishes the land and half of the fertilizer. Some few pay a cash rental per acre.

The negro is depended upon for labor and is fairly satisfactory. The labor problem, although always more or less difficult, seems to cause little trouble here. Negro hands get from \$12 to \$20 per month and their board.

A more diversified system of agriculture is gradually coming into use in the better sections of the county. More attention should be paid to crop rotations and particularly to the growing of hay and

feed crops. If more of these crops were grown and fed on the farm a greater supply of barnyard manure would be available and the expenditure for commercial fertilizers materially reduced.

The census of 1910 reported 129,970 acres of land in the area in farms, of which 40,260 acres were improved. The average-sized farm is given as of 120.6 acres. Land is assessed at \$2,063,611, buildings at \$445,610, implements and machinery at \$73,972, and livestock at \$320,989.

The price of land varies widely over the county, ranging from about \$7 in the rough, undesirable sections to \$60 and \$75 near town where the land is improved. In some places as high as \$100 an acre is asked.

#### SOILS.

The soils of Ben Hill County are derived from Coastal Plain deposits. Since the elevation of the region these deposits have been somewhat modified through weathering and erosion and the influence of vegetation. Oxidation and drainage conditions have been largely instrumental in influencing the coloring of the soils of the county. Over the well-drained areas, where oxidation has had ample opportunity to work, are found the bright yellow Tifton soils grading, in less favored localities, into the pale yellow of the Norfolk and over the lower-lying and swampy areas the gray soils of the Plummer series. Oxidation in varying degrees of intensity is also probably responsible at least in part for the color variations in the subsoil materials, especially in the Susquehanna soils.

The soils of Ben Hill County are all sandy and the textural range in the surface material is narrow, all of the soils being either sandy loam or sands except for some very small areas in the flatwoods. Nearly all of the upland soils, although sandy on the surface, are underlain by a clay subsoil at a depth of a few inches to about 3 feet. This clay is yellow in color where the Norfolk and Tifton soils occur, but at a depth of 4 to 6 feet it becomes very compact and mottled with drab, red, and yellow colors, and is frequently plastic. There are numerous exposures of clay "gall spots" in the rougher portions of the county, but none of sufficient size to show on the map. They have been caused by the removal of the surface sandy material through erosion. All the soils of the survey contain a large amount of sand ranging from the fine to the coarse grades. In the rougher parts of the county considerable quartz gravel is found. The iron oxide pebbles that are so abundant around Fitzgerald and some other parts of the county have probably been produced during the processes of weathering. These pebbles have the appearance of concretions. They vary in size from buckshot to a few inches in diameter, but very few larger than an inch in diameter are found.

The materials from which the soils of Ben Hill County come are deposits which were probably laid down in a shallow sea once covering this region. The deposits were probably somewhat assorted at the time of deposition. Since the elevation of the region they have been modified by the processes of weathering and erosion. But in this section the differences at the time of emergence appear to have been much the same as at present, for in many cases the soils do not give evidence of having been greatly altered since that time. The most important agents in weathering have been chemical changes, particularly oxidation processes which have had a large influence in effecting color differences. Drainage conditions have controlled oxidation to a large extent. Where the drainage has been good oxidation has taken place more rapidly, producing the bright-yellow color found in the Tifton soils. Where the drainage has been slightly less well established the pale yellow of the Norfolk soils occurs, while in the lower poorly drained semiswampy areas very little oxidation has taken place and the gray color of the soils of the Plummer series has resulted. Differences in oxidation have also probably been responsible for the variation in color that is found in the subsoil of the Susquehanna series.

Fourteen types of soil, including Swamp, are shown in the accompanying map, and in case of three of the types phases are also indicated by means of rulings, thus giving 17 separations. The Tifton series is represented by one type, the sandy loam and a deep phase of the type. This type is considered the best and most important agriculturally in the county, as well as over a large part of south Georgia. The Tifton soils are characterized by the large quantity of iron pebbles present.

The Norfolk series is represented by five types, the sand, loamy sand, sandy loam, coarse sand, and coarse sandy loam, with a flat phase of the sand and sandy loam. This series differs from the Tifton in the absence of pebbles and the lighter color of the subsoil, which is a paler yellow.

The Plummer series is represented by two types, the sand and sandy loam. This is a poorly drained series of light-colored soils and includes the semiswampy areas along drainage ways and at their heads.

The Susquehanna series is represented by two soils, the sandy loam and coarse sandy loam, but each type is variable; thus we may have areas of coarse sandy loam occurring where sandy loam is mapped and vice versa. It occurs in the rougher portions of the county and has a low value agriculturally.

The Portsmouth series is represented by two types, the loam and the sand, but the areas are so small that neither is typically developed and they are unimportant. This series occurs in the flatwoods and is

characterized by dark-colored surface soils with drab subsoils caused by poor drainage conditions which have been favorable for the accumulation of organic matter.

The Leon soils have been formed under much the same conditions as the Portsmouth, but for some reason there has been little accumulation of organic matter and we have an almost white surface soil with a copper-brown hardpan layer at no great depth.

Swamp is really a condition instead of a type and may include several types. It occurs on first bottom along the large creeks and the Ocmulgee River. It is alluvial in origin.

The following table gives the name and extent of each soil mapped in the county:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Tifton sandy loam.....	32,960	20.8	Plummer sandy loam.....	8,512	5.2
Deep phase.....	1,088		Norfolk coarse sandy loam....	6,848	4.2
Norfolk sandy loam.....	28,800	19.0	Swamp.....	4,800	2.9
Flat phase.....	2,368		Norfolk loamy sand.....	2,688	1.6
Plummer sand.....	30,080	18.4	Norfolk coarse sand.....	1,344	.8
Norfolk sand.....	16,320	11.9	Portsmouth sand.....	448	.3
Flat phase.....	3,200		Portsmouth loam.....	384	.2
Susquehanna sandy loam.....	14,080	8.6	Leon sand.....	256	.2
Susquehanna coarse sandy loam.....	9,664	5.9	Total.....	163,840	.....

TIFTON SANDY LOAM.

The surface soil of the Tifton sandy loam consists of gray, loamy sand about 6 inches deep, grading into a yellow sandy loam which continues to a depth of 15 to 18 inches. The subsoil is usually a friable sandy clay rather bright yellow in color, becoming heavier with depth and frequently showing in the lower part traces of red, due probably to iron oxide. The surface soil in many cases is a true sandy loam, but where this occurs the subsoil proper generally lies at a greater depth, there being a gradual change through a sticky sandy loam to the friable sandy clay. As a rule the transition from soil to subsoil is distinct and occurs at an average depth of about 16 inches. The most characteristic feature of the type is the presence of large quantities of dark reddish brown iron concretions scattered over the surface and throughout the entire soil section. These are commonly called "pimples," and the type is locally known as "pimply land." The pebbles are usually rounded and vary in size from that of a pea to several inches in diameter, the greater number having a diameter between one-fourth and three-fourths inches. In a few instances, notably in the Flatwoods along the Broxton Road, they occur in

layers, forming a sort of hardpan that is difficult to penetrate with the soil auger. These pebbles are usually present in greatest numbers on the ridge tops where the clay subsoil is found at a relatively shallow depth. In fields that have been under cultivation for sometime their presence is readily noticeable.

Although the type is fairly retentive of moisture, it is inclined to puddle when wet and on drying out sometimes becomes hard and compact, especially where the organic supply is low. It can, however, be tilled without a great deal of difficulty.

The Tifton sandy loam is the predominant type of the undulating to gently rolling section of the county. No continuous large bodies are found, as they are all interrupted by drainage ways and, where the topography becomes more nearly level, by areas of the Norfolk sandy loam. The type occupies low ridges and slightly undulating interstream areas sloping gradually to the drainage courses. The topography is sufficiently rolling to insure good drainage, but not enough so to cause much trouble from erosion.

The Tifton sandy loam is considered the best soil in the county. It produces good yields of cotton, corn, and oats with less fertilizer than any other type. It is capable of producing an average yield of 1 bale of cotton per acre, with proper fertilization and cultivation, although the average yield at present is probably about two-thirds of a bale per acre. Corn does well on this type, yields of 50 to 60 bushels per acre having been secured, but the average is probably about 25 bushels. Oats do well, as high as 50 bushels per acre having been obtained. Velvet beans and peanuts, the latter planted in the corn, are also grown on the type.

The original forest growth consisted of a heavy stand of longleaf pine, most of which has been removed.

This soil responds readily to manurial treatment or additions of organic matter in any form. By turning under green manuring crops and all available roughage, especially legumes, this soil could be improved to a point where the amount expended for fertilizers might be materially reduced.

This type at present is valued at \$15 to \$75 an acre, depending upon location and improvements.

*Tifton sandy loam, deep phase.*—The deep phase of the Tifton sandy loam consists of about 24 inches of a loamy sand, the surface 4 inches being gray and grading below into pale yellow. The subsoil is a yellow friable sandy clay containing considerable coarse material. Some "pimples" occur scattered over the surface and throughout the soil section.

This phase covers only a very small area and is rather unimportant. The separation was made for the reason that there is an appreciable

difference in crop yields over the phase and the main type. More fertilizer is necessary on this land for the production of good crops. The yields are lower and of inferior quality on account of the low water-holding capacity of the soil.

#### NORFOLK SANDY LOAM.

The surface soil of the Norfolk sandy loam consists of gray or pale-yellow loamy sand or light sandy loam, varying in depth from about 12 to 24 inches. The surface 3 or 4 inches carry some organic matter, imparting a dark-gray color, especially in forested areas. The subsoil is a bright-yellow friable sandy clay. In some places ferruginous pebbles are found in the surface soil, such areas representing an approximation of Tifton sandy loam.

Along the stream slopes in the rougher part of the county some patches showing in the subsoil a mottled red and gray color and plastic structure were included with the type. These, where large enough, were mapped as Susquehanna sandy loam, but their occurrence was so irregular or patchy that in many cases it was impossible to separate them from the Norfolk sandy loam.

The depth to subsoil varies greatly, in some instances being 30 inches or more. Where this is the case the surface soil has the appearance of a sand rather than a sandy loam. The subsoil here approaches a clayey sand or very sandy clay. This deeper phase occurs in spots throughout the county, but more particularly on the ridges in the rolling to hilly section. Here the soil carries a rather large amount of coarse material, making any distinction between the sandy loam and coarse sandy loam more or less arbitrary.

The Norfolk sandy loam is found throughout the entire county, both on the hilly uplands and in the flatwoods. The largest unbroken area is found in the northeastern part of the county along the Ocmulgee River.

The topography of this type varies from nearly level where the drainage is insufficient, to rolling or even hilly where the drainage is excessive. Usually where it is found associated with the Tifton sandy loam it occupies the lower slopes. In the rougher portion of the county it usually occupies the divides.

The Norfolk sandy loam was originally covered with a heavy growth of longleaf yellow pine. A good growth of wire grass is found throughout the forest. Most of the merchantable trees have been removed.

The Norfolk sandy loam ranks next to the Tifton sandy loam in productiveness. It varies considerably, depending upon the depth to subsoil. Cotton does fairly well on the type, especially on the shal-

lower areas. Over the deeper areas the cotton is easily affected by drought. Corn and oats do not yield as well on this type as on the Tifton sandy loam. Sweet potatoes, peanuts, velvet beans, water-melons, and all crops that do not have a very strong rooting system do well. Truck crops are also adapted to this soil, and the type should generally be selected by anyone wishing to engage in trucking.

The Norfolk sandy loam responds readily to good soil treatment, especially additions of organic matter. Peanuts, velvet beans, and cowpeas grown and turned under are recommended for this type.

Commercial fertilizers are used for the growing of all crops. Applications are usually slightly greater than on the Tifton sandy loam.

*Norfolk sandy loam, flat phase.*—This phase of the Norfolk sandy loam comprises flat or nearly level areas, the drainage of which is not so well established as in the more uneven, typical portion of the type. The soil consists of a gray to dark-gray sand, or slightly loamy sand, underlain at about 6 inches by grayish to pale-yellow loamy sand, which grades below, generally at about 26 to 30 inches, into yellow sandy loam or sandy clay.

This land is somewhat more productive than the Norfolk loamy sand, but it is not quite so productive as the shallower, typical Norfolk sandy loam. The poorer drained areas should be ditched. Rather heavy applications of complete commercial fertilizers are required for best results. Mixtures of cottonseed meal and potash salts, with a relatively small quantity of phosphatic material, are likely to give best returns. Liberal incorporation of vegetable matter, such as cowpeas plowed under green, is recommended.

The value of the Norfolk sandy loam ranges from \$10 to \$40 an acre, depending on location, topography, and improvements.

#### NORFOLK SAND.

Where typically developed the Norfolk sand consists of 4 or 5 inches of loose gray sand, underlain by pale-yellow sand, which continues to a depth of 3 feet or more. The surface half-inch or so is almost pure white, and composed almost wholly of pure quartz grains. In the areas east of the Allapaha River and along House Creek the sand is several feet in depth, but in the rolling section on the tops of ridges and small divides it is underlain at a short distance below 3 feet by a heavy sandy clay, which makes the soil more retentive of moisture, and consequently more valuable.

The principal areas of Norfolk sand are found in the western part of the county east of the Allapaha River, where there is an area from one-half mile to a mile in width bordering the river. Another area occurs in the northern portion of the county on both sides of

House Creek, near Bowens Mill. Numerous small areas are scattered over the county, usually occupying the crests of ridges and narrow divides between the streams.

The forest growth on the Norfolk sand consists usually of a scanty stand of blackjack and other species of oak, with a few scattering longleaf pine. Wire grass is not so plentiful as on heavier soils, while bear grass is quite common on the type. The latter grass is one characteristic feature by which this type may be distinguished.

The topography is usually undulating to gently rolling, although in the largest areas a true sandhill topography is developed in some instances.

Very little of the type is under cultivation, as it is considered too droughty and needs too much fertilizer to be farmed profitably. This is especially true if cropped to either cotton or corn, although in some areas it does very well where the clay subsoil is reached at 36 inches. With heavy applications of fertilizers good yields of all truck crops, watermelons, sweet potatoes, etc., can be made. Large quantities of organic matter, either in the shape of barnyard manure or the turning under of cowpeas or velvet beans, should be added where this soil is cultivated, as it is rapidly depleted of organic matter by cultivation.

The larger part of the Norfolk sand probably will not be brought under cultivation for some time, or until other more desirable soils are more nearly all developed, except where it is used for trucking near towns. The yields are not sufficient to make farming profitable under present conditions.

The type is valued at \$10 or less an acre, except where its nearness to railroads makes it more desirable.

*Norfolk sand, flat phase.*—The flat phase of the Norfolk sand consists of a gray to dark-gray sand, about 6 inches deep, fairly high in organic matter and underlain by a pale-yellow to grayish-yellow slightly sticky sand.

This phase occurs most extensively throughout the flatwoods area, and only a small portion of it was mapped. The drainage is only fair, but except in times of heavy rains is ample. Where heavily fertilized good corn yields can be secured.

The phase supports a good growth of longleaf pine, with some saw palmetto in the lower lying situations.

The principal difference between this phase and the typical soil is in topography.

#### NORFOLK LOAMY SAND.

The Norfolk loamy sand varies in depth from 20 to 30 inches. The first 5 or 6 inches consist of a gray to dark-gray loamy sand, grading

into a pale-yellow loamy sand, which continues to a depth of about 20 inches. Below this the material is somewhat heavier to a depth of 30 inches, where a sticky sand or very light sandy loam is encountered. This type represents a gradation between the Norfolk sandy loam and the Norfolk sand, approximating the deep phase of the former type and the better phase of the latter.

The Norfolk loamy sand is found only in the flatwoods section of the county, and then only in comparatively small areas. The topography is almost level to very gently undulating. Drainage is not good under present conditions, as the subsoil is usually saturated during a large part of the year. This condition, however, could readily be remedied by the use of tile or open ditch drains.

This type is considered by most farmers almost as good as the sandy loam of the same series and much better than the sand. It responds readily to good treatment and under liberal applications of fertilizers good yields of cotton can be secured. With careful handling and the incorporation of organic matter in liberal quantities by plowing under green cover crops this type could be made to produce good yields of the staple crops, and would be an excellent soil for early trucking purposes.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

*Mechanical analyses of Norfolk loamy sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
252027.....	Soil.....	1.4	15.6	20.4	33.6	20.2	6.7	2.0
252028.....	Subsoil.....	1.6	13.1	15.7	32.9	26.6	4.3	5.8

NORFOLK COARSE SAND.

The Norfolk coarse sand consists of 3 to 4 inches of gray coarse sand changing to pale yellow in the lower portion of the soil profile. The surface usually has a very light-colored or white appearance and may contain considerable quartz gravel. The material inclines to loaminess in the lower portions and may even become rather sticky at 36 inches.

This type is of small extent and of little importance, only a few small areas occurring in the county.

It supports a stunted growth of blackjack and other varieties of oak. It usually occurs topping the ridges or knolls, at the foot of the slope, or along the streams, where it represents coarse material washed down from above.

## NORFOLK COARSE SANDY LOAM.

The soil of the Norfolk coarse sandy loam consists of a gray coarse sand from 3 to 4 inches deep grading into a pale-yellow coarse sandy loam which continues to a depth of about 12 inches. This is underlain by yellow coarse sandy clay to a depth of 30 inches, mottlings of red being encountered in many places below this depth. Where the mottlings of red are found in the subsoil there is also a change in the structure of the material from a friable, mealy coarse sandy clay to a compact, somewhat tough and indurated coarse sandy clay. This material is only found at lower depths where the underlying bed of clay occurs which gives rise to the Susquehanna soils. This bed of hard clay lies near the surface along the brows of the slopes and on small knolls and produces a rather marked effect on the type. As these areas occur in small bodies, their separation from the typical soil was not practicable.

Owing to difficulty in establishing soil boundaries portions of the sandy loam have been mapped with this type.

The Norfolk coarse sandy loam occurs in broken areas in the north-central and eastern parts of the county. The largest areas occur in the vicinity of Georges Chapel, extending northward and eastward to the Ocmulgee River. The next important development is found just east of Union School, in the eastern part of the county. The topography is marked by sharp, narrow ridges and knolls to medium wide, gently undulating to level ridges. Immediately south of the river, extending to the River Road, the topography is flat, being broken here and there by streams passing through the areas. The occurrence of the type is restricted to the physiographic region having a broken topography. The type is well drained.

The origin of the type is the same as that of the Norfolk sand except that the fine material has been washed out of the surface mantle, leaving a larger proportion of coarse material.

The Norfolk coarse sandy loam supports a fair growth of longleaf pine and considerable scrubby blackjack and other varieties of oaks. The wire-grass growth is rather scanty.

The Norfolk coarse sandy loam has a coarser and looser surface soil than the Norfolk sandy loam, which makes it of less value for general farming purposes, but where the subsoil does not lie too far below the surface the crop adaptations are about the same. In fact, the yields in a few areas are about equal. Cotton yields from one-fifth to three-fourths bale per acre, depending upon variations in the type and upon cultural methods employed for the production of the crop. Corn yields from 10 to 20 bushels per acre. This type is excellently adapted to truck crops, such as lettuce, asparagus, canta-

loupes, and Irish potatoes. Where the type is found within easy reach of railroad facilities it could be profitably used for these crops. For the improvement of the type attention should be paid to the incorporation of organic matter, in which the type is notably deficient.

#### PLUMMER SAND.

The Plummer sand consists of gray to dark-gray loamy sand about 6 inches deep, resting upon a light-gray sand having somewhat the characteristics of quicksand and continuing to a depth of 36 inches. In places the surface 2 or 3 inches have accumulated considerable organic matter, making the color considerably darker. A gray sticky and plastic clay is often encountered in the lower portions of the subsoil, particularly near the heads of streams in the rolling sections of the county.

The type is found throughout the county at the heads of streams and along stream courses. It also occurs as low-lying areas in the flatwoods. Those areas along the streams are slightly more rolling than the areas in the flatwoods. The most extensive areas usually occur at the heads of streams narrowing to a small strip as the drainage way is better developed until a large stream is reached and a large valley is found. No large areas are found, though the numerous small spots throughout the county make a fairly large aggregate for this soil.

Drainage at present is poorly established, particularly over the low areas near stream courses, probably due to the quicksand character of the subsoil. Water can frequently be seen standing on the surface only a few feet from an open ditch. Where the type occurs around stream heads the drainage is also poor, on account of the underlying plastic clay and the accumulations of seepage waters from the upland, which keep it in a saturated condition during most of the summer months.

The vegetation of the type is distinctive, sedge grass taking the place of the wire grass found growing throughout the county. In the flatwoods and more level areas black gum, bay, and gallberry bushes and other water-loving trees and shrubs are found. The "trumpet flower," a pitcher plant, is found so universally throughout the type that it is known as "trumpet land."

Very little of this type is under cultivation because of its poor drainage, although most farmers prefer this land for their sugarcane patch, for which it is well suited. Rice is also grown on this type in a few instances.

This soil is considered as practically valueless land, except for the pasturage it furnishes.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of this type:

*Mechanical analyses of Plummer sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
252007, 252029.	Soil.....	4.3	16.1	15.7	34.9	21.8	5.7	1.4
252008, 252030.	Subsoil.....	4.0	13.8	14.7	35.6	23.6	6.9	1.9

PLUMMER SANDY LOAM.

The surface soil of the Plummer sandy loam differs little from that of the sand member of the series, consisting of a gray loamy sand to light-textured sandy loam about 12 inches deep, underlain by a gray sandy clay usually somewhat mottled.

The type is of small extent and unimportant in the county. It occupies the same topographic position as the sand and at present has about the same agricultural value. When drained, however, it should prove a better soil. The boundaries between the two types are rather indistinct, bodies of the sand occurring throughout the sandy loam and vice versa. It is probable that some of the stream-head areas shown on the map as the sand have a clay subsoil, so that they properly belong within this type. On account of the wet nature of the land, together with the low agricultural value, all areas were not examined as closely as the better soils.

Sedge grass and pitcher plant are the characteristic vegetation of this type.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

*Mechanical analyses of Plummer sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
252015.....	Soil.....	4.5	15.9	15.9	33.3	15.9	7.3	7.2
252016.....	Subsoil.....	4.3	12.4	13.5	30.6	16.6	7.2	15.4

LEON SAND.

The surface soil of the Leon sand consists of 4 to 5 inches of dark-gray sand, fairly high in organic matter. This is underlain by a nearly white sand extending to the hardpan layer found at depths ranging from about 12 to 20 inches. This hardpan consists of a thick

layer of dark-brown to almost black compact heavy sand grading below into yellowish-brown sand somewhat stained by infiltration of organic matter from the hardpan layer.

This type is found only in a few small areas and is not of much importance. A small area is found in the flatwoods southeast of the Ashton School, another in the southeastern part of the county, and a small tract on the flatwoods southeast of Fitzgerald.

The type is confined to the flatwoods and has a nearly level topography. At present it does not seem to lack drainage any more than the surrounding soils, but poor drainage has undoubtedly been an important factor in the formation of this soil. An attempt has been made to cultivate a little of this type, but the results were so unsatisfactory that cultivation was abandoned. The type is of low agricultural value.

The native vegetation is fairly distinctive. The wire-grass growth is scanty, but saw palmetto is abundant.

#### PORTSMOUTH SAND.

The surface soil of the Portsmouth sand consists of a dark-gray to black sand, loamy in character, high in organic-matter content, and ranging in depth from 8 to 12 inches. This is usually underlain by a stratum of brownish sand having the character of a hardpan which becomes lighter colored with depth and in the lower portion may vary from an almost white incoherent sand to light-brown or drab sticky sand.

This type is found in only a few small areas throughout the flatwoods. It occupies poorly drained, slightly depressed or flat areas and drainage-way depressions. A few ponds, probably of Portsmouth loam, occur within the type. The tree growth is mostly long-leaf pine, with cypress in the ponds and more swampy areas. The smaller vegetation consists of saw palmetto, gallberry, sedge, and wire grass.

None of the type is under cultivation, although corn could be grown upon it if the land were drained. Applications of lime would also be necessary to correct soil acidity.

#### PORTSMOUTH LOAM.

Where typically developed the surface soil of the Portsmouth loam consists of a black, mucky loam with an appreciable content of sand, about 12 inches deep. The subsoil is a dark-colored drab clay loam grading at about 30 inches into mottled drab and yellow clay which becomes a dingy yellow plastic clay in the lower portion of the 3-foot section.

This type occurs as small cypress ponds scattered throughout the flatwoods. Some of these ponds contain Plummer sand. In addition to cypress the ponds support a growth of bay, black gum, and titi. The heavier soil is usually found in the titi region.

Under present conditions this type is uncultivated. When drained it can be used for corn, onions, and cabbage.

#### SUSQUEHANNA SANDY LOAM.

The surface soil of the Susquehanna sandy loam consists of a gray sandy loam varying in depth from about 14 to 18 inches, frequently containing considerable coarse material and angular quartz. The subsoil is a stiff, plastic clay, usually mottled with gray and red. Near the boundaries of the Norfolk sandy loam the mottling varies to bright yellow and red. The depth of the surface mantle of sandy loam varies greatly, erosion having been active over the type. In some places the surface covering is only a few inches in depth, while in others the clay subsoil is covered to a depth of 30 inches or more.

The Susquehanna sandy loam is found throughout the rougher portion of the county, where it occupies slopes above the Plummer sand and narrow sloping strips between the drainage ways. In a few instances it is found on the tops of divides or may include the entire divide. It usually occupies an intermediate position between the Plummer and Norfolk soils. Areas too small to map occur scattered throughout the Norfolk sandy loam.

The topography is gently rolling to rolling, affording good drainage. In many cases on the lower slopes, where the fall is not so great, a saturated condition exists due to accumulation of seepage waters from the higher land near by.

The native vegetation consists of longleaf pine, scrub oak, and a good growth of wire grass.

Very little of this type is cultivated and only where it occurs closely associated with the Norfolk soils. It is considered a poor agricultural soil, and under present conditions its best utilization is for forestry.

#### SUSQUEHANNA COARSE SANDY LOAM.

The surface soil of the Susquehanna coarse sandy loam consists of 3 to 4 inches of coarse gray sand grading into a pale-yellow, coarse sandy loam which extends to a depth of about 10 inches. The subsoil is a yellow, friable, coarse sandy clay which continues to a depth of about 24 inches, at which point it becomes somewhat plastic and mottlings of red and yellow appear.

The type differs but little from the sandy loam of this series, with which it is always associated, the main difference being in the amount

of coarse material found in the surface soil. This varies to such an extent in both types as to make separation in places rather arbitrary. The depth of the surface mantle of sandy material ranges from only a few inches to 3 feet, the average being from 15 to 18 inches. The subsoil material is also variable, ranging in color from a yellow mottled with red to a red slightly mottled with yellow and gray. In some cases it is gray slightly mottled with red and yellow. In texture it ranges from a fairly friable sandy clay to a very compact, plastic clay, almost impervious to moisture.

The type is found in the rougher sections of the county, where it occupies fairly steep slopes above the Plummer soils and sharply defined ridges. It occurs throughout the entire survey, usually associated with the Susquehanna sandy loam.

Outcrops of fairly coarse-grained sandstone are more frequent in this type than in the sandy loam, thus giving it a rough-appearing topography.

Little of the type is under cultivation. Where the more friable subsoil occurs the type should give fair yields of cotton, with liberal applications of fertilizer, but the general topography is such as to make it unsuited for agriculture. Locally there is no distinction drawn between the sandy loam and coarse sandy loam, although the latter is the less desirable.

Land values are about the same for the one type as the other, ranging from \$7 to \$15 an acre.

#### SWAMP.

The Swamp of Ben Hill County includes low-lying land along stream courses that is subject to overflow, poorly drained flat areas usually known as cypress ponds, and overflow land along the Ocmulgee River. The area mapped as Swamp in the northern part of the county along the Ocmulgee River is a true alluvial soil and should be given a type name, but during the progress of the survey the area was continually under water and there was no opportunity to determine the character of the soil.

The materials composing the soil have very little uniformity. Along the stream courses, as a rule, these are very much like the Plummer sand. The surface material is usually of a dark color, owing to the large content of organic matter, while the subsoil is usually a light-gray sand.

The Swamp supports a heavy growth of cypress, black gum, sweet gum, and other water-loving trees, with an undergrowth of titi and other shrubs.

Under present conditions the Swamp can not be used for agriculture and has no value except as a range for hogs.

## SUMMARY.

Ben Hill County is located in the south-central part of Georgia, about 70 miles from the Florida State line. It has an area of approximately 256 square miles, or 163,840 acres. The survey lies within the Coastal Plain, and embraces three fairly well-defined topographic divisions, the flatwoods, gently rolling country, and a section which is rough and hilly.

The drainage waters flow generally to the northeast into the Ocmulgee River, which forms a part of the boundary line of the county.

Fitzgerald, the county seat, is the only town in the survey. It has a population of 5,795 and is an important local railroad center, being the junction of the Atlanta, Birmingham & Atlantic, the Ocilla Southern, and the Seaboard Air Line.

The climate of the area is mild and equable, and extremes of temperature are rare. The annual mean precipitation is 50.9 inches, well distributed throughout the year, the average for the summer months being 18.5 inches.

General farming is the prevailing type of agriculture, although pecan growing gives promise of soon becoming an important special industry. Cotton, corn, oats, and peanuts are the principal crops, in the order named.

Six soil series, embracing 13 soil types and 3 phases, were separated and marked in the county. The Norfolk series is represented by 5 members, a sandy loam, sand, loamy sand, coarse sand, and coarse sandy loam. The Plummer series is represented by a sand and a sandy loam, the Portsmouth by a sand and loam, the Susquehanna by a sandy loam and coarse sandy loam, and the Tifton and Leon by one member each, a sandy loam and sand, respectively.

The Tifton sandy loam is considered the best soil of the county. It is well adapted to the general farm crops and is the predominating type over the undulating to gently rolling section of the county. It produces good yields of cotton, corn, and oats and with less fertilizer than any other type in the survey. Its value ranges from \$15 to \$75 an acre. A deep phase of this type was also separated and mapped.

The Norfolk sandy loam is the most important member of the Norfolk series. It is considered nearly as valuable as the Tifton sandy loam for the general farm crops, though it commands slightly lower prices. The other members of this series occur only in limited areas and are not important individually.

The Susquehanna soils, though extensive, are not generally used for agriculture except over the better drained areas. They are found in the rougher portions of the county.

The Plummer series, represented by a sand and sandy loam, are poorly drained and of low agricultural value. No large areas of

these soils exist in the county, although in the aggregate they are fairly extensive.

The Portsmouth and Leon soils occupy small areas and are unimportant.

More careful attention to seed selection and the adaptation of crops to soils should be practiced. More hay and forage crops should be grown and a definite crop rotation established.



[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled*, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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